

That the plant investment costs to extend the life of a cable investment for a new life cycle may be less than the costs required for the preceding life cycle is not surprising. Several factors contribute to reduced costs over time, including:

- Certain costs, once sunk, do not need to be incurred again. For example, much of the make ready expense for aerial construction and the trenching and conduit expense for underground construction may be one-time expenses, not required again even if the cable on the poles or in the conduits is replaced.
- Many upgrades can be accomplished with only limited or partial replacement of plant (for example replacing only electronics and sections of trunk, but continuing to use existing sections of feeder cable).
- The electronics equipment cost curve generally and in the cable industry in particular has trended downward, as is well-documented in numerous trade publications.
- Channel capacity capabilities have increased dramatically, significantly lowering the unit cost of investment per channel.

The applicable average wage level, which may inflate over time (but not necessarily), is the most significant countervailing factor. However, the Commission has already established an inflator mechanism for the benchmarks. As it is presently crafted, this mechanism could potentially over-compensate operators. For instance, if an operator makes an upgrade in 1994, that operator's benchmark may continue to inflate each year beyond 1994 even though the operator's capital outlay requirements may be very limited for several years after the upgrade.

In summary, I am aware of no evidence before the Commission that would allow the Commission to conclude that increases over the benchmarks are required to cover upgrade costs.

(d) Regardless of the benchmark rates, operators have sufficient incentives to upgrade systems. Cable operators upgrade their systems for several reasons in addition to the possible opportunity to increase regulated rates. These reasons include the following, for example:

- Providing additional unregulated services on an expanded channel capacity and giving subscribers an easy means to order these services, generating additional revenue
- Expanding the subscriber base by providing a broader range of services and better signal quality and reliability
- Reducing operating costs through reduced needs for maintenance and repair and avoidance of the need to roll trucks to change subscriber services
- Improving system security to reduce theft of service.

These points are well documented in the industry trade press. Additional benchmark adjustment incentives are not necessary to induce plant investment.

**REBUILD COST AND REVENUE MARGINS FOR SELECTED SYSTEMS (BASED ON ERNST & YOUNG DATA, WITH CERTAIN ADJUSTED ASSUMPTIONS)**

System Location	(1) Total Capital Cost (\$000)	(2) Annual Depreciation Cost (\$000)	(3) Annual Return and Taxes (\$000)	(4) Total Annual Cost (\$000)	(5) Total Channel Capacity	(6) Rebuild Cost per Channel (\$000)	(7) Number of Subscribers	(8) Monthly Rebuild Cost/Channel/Sub
California	\$2,525	\$210	\$189	\$400	80	\$5.00	9,588	\$0.04
California	\$2,661	\$222	\$200	\$421	80	\$5.27	8,182	\$0.05
Tennessee	\$2,745	\$229	\$206	\$435	61	\$7.13	5,890	\$0.10
Tennessee	\$2,872	\$239	\$215	\$455	61	\$7.45	4,010	\$0.15
Florida	\$4,000	\$333	\$300	\$633	78	\$8.12	22,943	\$0.03
Minnesota	\$2,213	\$184	\$166	\$350	69	\$5.08	6,219	\$0.07
Minnesota	\$1,002	\$84	\$75	\$159	69	\$2.30	6,950	\$0.03
Texas	\$742	\$62	\$56	\$117	60	\$1.96	1,800	\$0.09

1. From Ernst & Young, Attachment 2, Table 2

2. From Ernst & Young, Attachment 2, Table 2

3. Total capital cost X .5 X 15%

4. From Ernst & Young, Attachment 2, Table 2; sum of Column 2 and Column 3

5. From Ernst & Young, Attachment 2, Table 1; total channels applied instead of added channels because rebuild upgrades the total system

6. Column 4 divided by Column 5

7. From Ernst & Young, Attachment 2, Table 1

8. Column 6 divided by Column 7 divided by 12 months

System Location	(9) Monthly Benchmark Revenue Increase per Added Sat. Channel	(10) Monthly Rebuild Cost/Channel/Sub	(11) Benchmark Revenue Margin/Satellite Channel/Month	(12) Rebuild Cost per Subscriber
California	\$0.16	\$0.04	\$0.12	\$264
California	\$0.17	\$0.05	\$0.12	\$326
Tennessee	\$0.24	\$0.10	\$0.14	\$482
Tennessee	\$0.24	\$0.15	\$0.09	\$716
Florida	\$0.14	\$0.03	\$0.11	\$174
Minnesota	\$0.17	\$0.07	\$0.10	\$356
Minnesota	\$0.15	\$0.03	\$0.12	\$144
Texas	<u>\$0.16</u>	<u>\$0.09</u>	<u>\$0.07</u>	<u>\$412</u>
Average	\$0.18	\$0.07	\$0.11	\$359

9. From Ernst & Young, Attachment 3, Table 3

10. From Column 8 above

11. Column 9 minus Column 10

12 Column 1 divided by Column 7

# EMBEDDED GROSS PLANT COSTS OF SELECTED CABLE SYSTEMS

	(1)	(2)	(3)	(4)	(5)	(6)
<u>System</u>	<u>Subscribers</u>	<u>Approximate 1991 Embedded Gross Plant Investment per Subscriber*</u>	<u>Annual Depreciation per Subscriber</u>	<u>Annual Return and Taxes per Subscriber</u>	<u>Channels</u>	<u>Embedded Plant Investment per Subscriber per Channel per Month</u>
Illinois	39,000	\$439	\$37	\$33	44	\$0.13
Illinois	55,921	\$744	\$62	\$56	50	\$0.20
Illinois	34,230	\$623	\$52	\$47	55	\$0.15
Ohio	42,788	\$332	\$28	\$25	42	\$0.10
Ohio	3,546	\$623	\$52	\$47	45	\$0.18
Oregon	71,131	\$653	\$54	\$49	63	\$0.14
Oregon	67,562	\$459	\$38	\$34	49	\$0.12
Oregon	53,934	\$303	\$25	\$23	57	\$0.07
Virginia	12,825	\$669	\$56	\$50	63	\$0.14
Washington	47,287	\$839	\$70	\$63	56	\$0.20
Washington	<u>78,925</u>	<u>\$710</u>	<u>\$59</u>	<u>\$53</u>	<u>38</u>	<u>\$0.25</u>
<b>Average</b>	46,104	\$581	\$48	\$44	51	\$0.15

1. From information submitted to franchising authorities
2. Gross plant amount from financial statements submitted to franchising authorities; excludes converters and drops (exclusion estimated in some cases); plant investment amount divided by Column 1
3. Column 2 divided by an assumed 12 year depreciation life
4. Column 2 multiplied by an assumed 15% to cover return on investment, multiplied by a 0.5 factor to average the net plant value over the life of the investment
5. From information provided by franchising authorities
6. Column 3 plus Column 4, divided by Column 5, divided by 12 months

**EXHIBIT B**

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**Title: BIG FIBRE PLANS BY US CABLE TV MAJORS**

Ambitious four-year plan to re-wire its US networks with 7,000 miles of optical fibres unveiled by world's largest cable television group TeleCommunications Inc (5619 DTC, Parkway, Englewood, Colorado 80111, USA; +1/303/267-5500) adds to mounting evidence of momentum for rebuild with fibre

optic technology among US cable operators (see also 1993/76b1). By end 1993,

TCI will have spent \$750m to instal fibre for 40 per cent of its 10m subscribers and another \$1,250m to pass total of 90 per cent by end 1996. Plan involves construction of series of fibre rings which eliminate need for conventional headends, saving about \$20,000 a year per headend. TCI claims \$1m cost of fibre ring in Pittsburgh will be offset by \$1m savings in first year alone.

Third largest US cable group Continental Cablevision (The Pilot House, Lewis Wharf, Boston, Massachusetts 02110, USA; +1/617/742-9500) has given notice of its fibre plans which envisage linking 23 headends in New England with 160 miles of fibre, creating six 'super headends' by 1996. Continental has concurrently been testing compressed digital advertisement-insertion technology with Digital Equipment Corp.

Not to be outdone, the seven regional Bell telephone companies recently said they will spend \$125,000m upgrading their networks by 2000 and \$450,000m by 2015--\$100,000m more than previous plans (see also "Telcos continue trend to advanced video" in this section).

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Title: ADELPHIA PLANS TO DEPLOY FIBER MUCH FURTHER THAN FIBER-TO-FEEDER DESIGN

Adelphia Communications Corp. said recently it would rebuild the system it manages and operates in Syracuse, N.Y., employing a 750 megahertz (MHz) Passive Cable Network Architecture (PCNA). This network will string fiber much more deeply into the network than a conventional fiber-to-feeder design, will involve no coaxial amplifiers, and will have full two-way capability. Adelphia, based in Pennsylvania, believes advantages of PCNA include enhanced

reliability, improved operational simplicity, additional return path capability, and easier bandwidth expansions in the future.

The Syracuse design will involve home run fiber construction to optical receivers feeding pockets of some one mile of coaxial plant. Adelphia expects the costs of this network to be about the same as a 750 MHz fiber-to-feeder design.

"As adding successive increments of bandwidth through coaxial technology become increasingly difficult and as optical electronics become better and less expensive, the movement of fiber closer to the home becomes more attractive," said Dan Liberatore, vice president of engineering at Adelphia.

Adelphia engineers noted, however, they are still unsure if PCNA is economical in less urban environments.

"This design is approaching the optimum engineering balance for fiber and coax technologies," said Dan Whelan, director of Telecommunications Division of the New York State Commission on Cable Television. "This design will give the city of Syracuse what will rank among the most advanced and flexible system designs

we have seen to date." (Daniel Liberatore, Adelphia, 814/274-9830.)

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# TECHNOLOGY

## Jones Interdiction Test Nets Subs, Security & Cuts Costs

By PETER LAMBERT

**F**or any MSOs or franchise authorities considering interdiction as an alternative to in-home addressable converters — and Scientific-Atlanta Inc. says others are looking hard at it too — Cablevision Systems Corp.'s agreement to purchase interdiction hardware three weeks ago may not be enough to spur a purchase.

Gary Trimm, president of S-A's Subscriber Systems Division, said that although the technology is not a panacea for every operator in every situation, initial results in the field appear highly favorable for any operator seeking to balance ease and cost for consumers and system operations.

Jones Intercable of Elgin, Ill., has an 18-month interdiction head start on the industry, and system general manager Michael Lovett likes what he sees: a 10 percent gain in pay penetration, a 6 percent basic subscription lift and estimated annual savings of \$100,000, mainly in labor costs.

Lovett attributed the gains to a pervasive rebuild, during which the Elgin system has migrated nearly 17,000 subscribers to an interdiction system that "takes the addressable converter and puts it out on the pole."

Overall, Jones has spent about \$17 million to upgrade the Elgin system since mid-1991. Most of that investment has gone to a coaxial rebuild from 300 MHz to 450 MHz. At the same time, the operator has introduced three programming tiers: a broadcast and public, education and government access channel package; a limited satellite services package; and a complete satellite package.

### AVOIDING TRUCK ROLLS

The S-A technology allows Jones to activate or shut off programming packages from the headend, without costly truck rolls. That flexibility from the headend

will allow Jones to offer free, weekend trial service to approximately 1,000 subscribers, beginning in late March. S-A will supply interdiction modules on consignment for that market test.

"We see a great opportunity in apartment buildings and already wired homes," Lovett said, adding that he finds himself returning again and again "to the analogy that it's like a phone installation; you simply activate the line" without a visit to the home.

The business of analyzing hard marketing numbers on the interdiction approach to a la carte and free service trials will not begin until about next August. But Lovett said Jones' \$1.5 million to \$2 million investment, to date, in the S-A interdiction modules has already proved out multiple benefits: higher penetration, lower labor costs and improved signal security.

"The focus is on this very anti-historic approach: getting away from equipment in the home," he said. "The technology can allow us not only to segment in channel groups from the headend, but, eventually, allows channel-by-channel sales."

"If there's any limitation, it's in billing software, which we are looking at, and perhaps also with our programmers. This approach doesn't match cable history," Lovett said.

Jones Intercable's Ken Wright, director of technology, and Jay Carlson, fund engineering director, are convinced that the technology is proven. "Failures have been minuscule," Wright said, adding, "The question is whether marketing can drive new revenue to offset incremental costs." Those new revenues could come from non-subscriber pay-per-view, weekend pay subscription and other services thought impossible until now, he said.

### CONVERTER ON A POLE?

S-A's Trimm conceded that de-



scribing the technology as putting an addressable converter on the pole is a fair analogy from the user-interface point of view, but not technically accurate.

Employing an entirely different form of signal security, the interdiction approach can resolve many consumer-equipment-compatibility barriers, but it does not offer subscribers built-in impulse pay-per-view or some other features integrated into many converters.

And although both set-tops and interdiction modules employ com-

parable addressable circuitry at comparable costs, the necessity of mounting interdiction hardware outside requires more costly housing.

The standard interdiction scheme delivers a signal in the clear to a module with one, four or eight ports, translating to one port per home. When the headend addresses a port, the full broadband signal passes from port to home, minus the signals that the headend has instructed the module to jam.

Cable-ready TVs and VCRs re-

ceive an unscrambled set of signals minus one source of interference. And, unlike set-top converters, most of which can unscramble only one signal at a time, the interdiction modules pass all authorized signals simultaneously.

That allows multiple-signal consumer equipment features, such as watch-and-record and picture-in-picture, to operate freely.

"Interdiction is another application," said Trimm. "It doesn't handle some features, like impulse PPV and it's a little more expensive. But it has a good, couple-of-years payback in customer satisfaction, higher penetration and lower operations costs."

### SECURITY

In Jones of Elgin's case, the interdiction modules replace 15-year-old negative traps hardware. That, said Lovett, has brought Jones of Elgin "from one of the least secure to one of the most secure systems possible."

Although signals travel in the clear from the headend, they cannot go past the interdiction port unless the headend addresses the port.

Conceding that the Jones of Elgin system enjoys the privilege of operating an interdiction system before anyone has put his mind to breaking the new technology, Lovett believes creating a black market in the modules will prove difficult.

To jam a signal, the S-A interdiction module uses voltage control oscillator input to apply energy close to the appropriate video signal frequency. That energy "confuses" the TV tuner into failing to pick up the singled-out channel.

The module applies jamming energy in a random time sequence, "so the amount of equipment required to anticipate that random sequence would be extremely expensive and, technically, practically impossible," said Trimm.

Added to that expense and difficulty

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# Jones Interdiction Test Nets Subs, Security & Cuts Costs

**CONTINUED FROM PAGE 48**  
culty is the fact that pirated interdiction platforms would be much harder to come by than are alterable converters, which Trimm said disappear at a rate of 10-15 per-

cent a year. Trying to sell stolen boxes in heavy, unattractive metal housings could also prove vain.

And finally, the S-A equipment employs an anti-tampering device, which shuts down the module

when the housing is opened without authority.

Signal thieves could still try several of the same approaches available in a system with addressable set-tops. They could tap

**"It's like a phone installation; you simply activate the line."**

**Michael Lovett,  
GM, Jones Intercable  
of Elgin, Ill.**

into hardened cable upstream from the module, an approach that brings telephone calls from every subscriber downstream. Or they could split a subscriber's line after the module, which operators already must trace through visual audits.

All in all, Lovett, like Trimm, expects signal thieves to have a hard time creating a significant black market. "I think the module is much more difficult to break than an addressable converter," Lovett said.

## **PORT ECONOMICS**

S-A has agreed to begin delivering single-port interdiction mod-

ules to Cablevision Systems by March. For now, the company is delivering four- and eight-port modules. Trimm acknowledged that deciding port configurations may be the riskiest part of deploying interdiction.

In the simplest terms, where homes are close together, having more ports makes more economic sense. In multiple dwelling units, where churn and truck rolls are highest, interdiction deployment promises greatest savings.

Lovett's 17,000 subscribers now served via interdiction account for about 58 percent of homes passed in an area he described as "almost urban." Using four- and eight-port modules, Jones of Elgin has already covered the remainder of its homes passed. On average, he said, 2.5 of the four ports are in use; he believes that figure will increase.

In some cases, particularly in multidwelling homes already wired but with non-subscribers, Jones has left consumer interfaces with building managers. That will allow the system to switch on service from the headend, also without a truck roll. ■



# Outlook for '93: Fiber on Parade

By GARY KIM

**M**ajor MSOs' capital expenditure budgets for 1993 will edge up slightly from 1992 levels, with 10 to 15 percent growth in spending for plant-related items, executives suggest.

Operators are planning significant increases in optical fiber and amplifier purchases, while set-top purchases will be consistent with 1992 spending and remain largely flat. So far, executives insist they haven't changed capital spending plans because of the 1992 Cable Act.

Why is so much fiber going in next year? The same reasons as always: greater reliability and better picture quality; the ease in expanding the bandwidth to 750 MHz and 1 GHz; and the continuing drop in cost.

It's now slightly more expensive to put in a straight 550 MHz coaxial build than fiber-to-the-feeder, suppliers and operators say.

Operators are also laying in extra fibers adjacent to what's needed for today's busi-

ness in order to be prepared for tomorrow's new opportunities: personal communications networks, telephony or video-on-demand.

Contrary to what some others say on programming, Cablevision Industries Inc. and another top-10 MSO said they're pouring more money into fiber rebuilds in order to add new programming.

Set-top sales should be flat, operators said, largely because they made most of their major addressable investments in advance of the PPV Olympics. And with sales of pay services continuing to stagnate, operators

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## CONTINUED FROM PAGE 3

have little need to order more converters.

One thing is certain: plant investment seems to be a high priority, to fend off competitive threats and to position systems for new opportunities.

Even executives who remain cautious about the prospects for new revenue streams in areas such as PCNs or multimedia say they are plowing money into plant.

A company as cautious as Cablevision Industries now expects to step up the tempo of its FTF deployments, especially for upgrades. Engineering senior vice president Joe Van Loan said CVI's 1993 capital budget would be "a replay of 1992," with plans to rebuild or upgrade between 5,000 and 5,500 miles of plant.

Van Loan thinks the cable industry ultimately will enjoy "modest" success in the PCN area and "personally is not convinced yet that multimedia isn't a replay of videotex," which failed to achieve mass-market appeal in the early 1980s.

Still, none of that is stopping him from investing heavily in fiber-to-feeder networks that offer "a good position for future new services and telecommunications."

Few thought the 1992 Cable Act to be a major factor in their 1993 capital plans.

For one thing, "our lawyers tell us it's too early to tell much about the capital impact" of the Cable Act, said Van Loan.

For another, operators said it was too late to tinker with their budgets anyway.

Though there could be "some foot-shuffling in the consumer interface area, I don't think there'll be any real freeze on spending," said InterMedia Partners engineering vice president David Large, adding that the MSO will continue with plans to rebuild recently acquired systems.

Maturation of cable's core business is encouraging pursuit of new markets, said former Warner Cable senior vice president Brad Johnston.

"We've already gotten to the point where we've built plant at 20 homes a mile," said Johnston. Building plant at densities lower than that is generally not

economically viable, he said.

"At 15 percent annual growth, there's no pressure to make risky decisions," he said. But looming competition and "tremendous opportunities on the telephone and video-on-demand side" are convincing operators they need to move, said Johnston.

Here's a rundown of some MSOs' plans for 1993:

- Tele-Communications Inc.'s capital budget will be in the \$500 million range, on par with last year's, officials said. By 1994, however, TCI's spending could conceivably swell dramatically because re-franchising considerations will drive major construction projects, they added.

- Time Warner Cable Group officials declined to comment on their plans, but when they were separate units, American Television & Communications Corp. appeared to have been budgeting about \$200 million a year for the past three years and Warner Cable Communications Inc. had been setting aside about \$70 million for each of the past three years, suggesting that the Time Warner Cable Group's capital budget will come in around \$270 million for 1993.

- Times Mirror Cable Television is in the midst of a five-year rebuild and fiber upgrade program that is running at a consistent \$100 million a year rate, said company spokeswoman Susan Ritchie. "For us, it's business as usual," she said. "There's been no reforecasting because of the Cable Act."

- Cox Cable Communications will probably be right in that range as well. Cox Cable senior vice president Alex Best noted at this year's Eastern Show that his firm has a \$100 million capital budget.

- Prime Cable probably will spend a bit more, but generally plans to stick to the 1992 pattern, said Dan Pike, Prime Cable engineering vice president.

- Another top 10 MSO's 1993 capital budget will be up a bit from 1992, with much of the focus on "more fiber, more hubbing, more upgrades and more fiber-to-the-serving area," said a source who asked not to be identified. Set-top budgets will be flat, he said. ■



"I don't think [the 1992 Cable Act] will be an issue."

David Large,  
InterMedia Partner

# FORUM

## Interdiction, Compression — What's an Operator To Do?

By STEVE NECESSARY

I have followed with interest the series of articles on interdiction and digital compression. I would like to offer my thoughts on the subjects.

Lately, much has been written on the compatibility of digital compression and interdiction. Although the industry had begun to embrace the concept of interdiction on its own merits, digital compression introduced considerable confusion on how the two will interface. Yet, interdiction and compression are entirely separate and complementary technologies.

To attempt to clarify the subject, I would like to examine some compression and interdiction issues. To begin with, even assuming that a digital decompression device becomes cost-effective, what is an operator's application for compression? Is anyone planning to convert his entire cable system to a fully compressed system, therefore requiring a device in every home? I don't think so.

Digital compression will likely be used for near video on demand (NVOD), which will be limited to those homes contributing incremental revenue. The control of non-compressed analog signals will continue to be a separate issue, even when digital compression is widely deployed.

When operators look at the possibility of using interdiction for signal control, it should be from the viewpoint of how interdiction addresses fundamental operational performance, in particular, in comparison to how addressable converters do the same job.

The first item to look at is consumer friendliness. It is good that we, as an industry, are making converter advancements with such items as on-screen displays and bypasses. But I ask, is that a solution? It's one thing to provide a product in a home that adds value, but it's another to introduce a product which is duplicative of the value that exists, or worse, takes away from it.

Cable-ready television sets are already at a high penetration level. Clearly, that number will only increase in the future, which will increase the number of unhappy subscribers looking at converters on top of their state-of-the-art cable-ready sets. Making the box do more is not the answer; that is doing nothing more than burdening the wrong foundation with more cost and consumer complexity.

Secondly, and frankly the most compelling reason to use interdiction, is operational improvement — the advantage of having an automated, intelligent system. Truck rolls are reduced, addressable converter theft goes away and, as a byproduct of interdiction, you've also got an improvement in the drop itself. If an operator installs what is now intended to be a very permanent drop, he can afford to make that drop more rigid, use better connectors and spend more time in the installation procedure.

This automated, intelligent system is also going to go head to head with potential competitors. If the telcos are allowed in cable television, with their kind of long-term investment attitudes, what kind of system are they likely to put in? In all probability, it will be an automated system invisible to the consumer.

And the telcos are not the only threat. Other competitors, such as DBS and MMDS, are looking at the same digital compression opportunities as the cable industry — compression is definitely changing the complexion of the competitive environment.

As an operator, you need to ask yourself, "Do I want to be in a race with the same horses, or



NECESSARY

do I want a better horse?" Interdiction certainly offers the capability to have a better delivery system, and a more competitive one.

The last point, and one that applies to decompression devices, is that not everything an operator might place in the home is bad. It's only bad if it interferes with or detracts from the service it's offering. A basic converter adds a lot of value if you don't have a cable-ready set. And as such, a decompression device would be just fine in the home ... if it adds capability as opposed to duplicating.

But think about what the device is going to be. A digital decoding device that allows, through regular NTSC signals, the application of NVOD capabilities. And if you take NVOD to a logical conclusion, it's going to be a set of services that are very competitive with tape rentals and interactive information services.

In summary, interdiction can be viewed as providing operational savings; as well as signal control over the analog broadband services that will be the dominant delivery system for a long, long time. Decompression devices, for digital transmission, will work well for providing additional value above and beyond what people currently have. And when added to a transparent device in a subscriber's home, digital decompression will be adding value in a consumer-friendly environment.

Compare that to the complexity of adding a digital decompression device to an addressable analog converter with on-screen display functions, picture in picture, electronic guides and so forth. The contrast is striking — simplicity and value added versus complexity and value reductive. ■

(Steve Necessary is president of Regal Technologies Ltd.)

Interdiction certainly offers the capability to have a better delivery system

## Fiber Reaches Important Cost Crossover: Experts

**A**TLANTA — Scarcely two years after it began pursuing optical fiber technology in earnest, the cable TV industry seems to have reached an important financial watershed: it now costs no more to build plant using fiber than it does to build with coaxial cable, according to several speakers on panels at the recent National Cable Television Association convention.

Indeed, American Television & Communications Corp. reported new findings indicating that it is now possible to build fiber trunk at costs equivalent to or less than conventional 450-MHz coaxial cable plant.

Jerrold Communications researchers said a recent design of a 350-mile, 42,000-subscriber system with 120 homes passed per mile showed rebuilds using AM fiber optic technology will cost a low of \$46 per home to a high of more than \$250 per home, depending on the required signal quality, bandwidth, and network design chosen. These estimates include the cost of conventional RF electronics, the Jerrold researchers noted.

The lower figure represents plant built to 550-MHz specifications and delivering 45 dB noise performance to all homes while the higher figure represents 750-MHz plant with 49 dB end-of-line noise performance.

By contrast, two top-15 MSOs calculate that they can rebuild 450-MHz plant (providing 60 channels) at an average cost of between \$50 and \$60 a subscriber. Jerrold pre-

dicts that it can deliver 80-channel, 550-MHz systems with signal quality more than 50 percent better than today's industry standard (45 dB carrier-to-noise) for \$75 to \$97 a subscriber.

Costs for digital transmission gear also are declining. David Jordan, C-COR Electronics Inc. product manager, estimated at "slightly over \$2,000 per channel" the cost of an 80-channel digital system used to interconnect two headends separated by 52 km, and distribute that signal to four hub sites, at distances varying from 13.9 km to 28 km.

By contrast, FM systems offering lower noise performance and lower channel loading, with signals distributed to three hubs, cost \$6,800 to \$21,000 per channel as recently as two years ago.

Financial savings will also accrue with careful selection of a network topology, said Larry Lehman, vice president, Cencom Cable Associates.

Cencom found it could reduce by 40 percent the number of AM hubs required if it used a design similar to the "fiber backbone" architecture developed by ATC, Lehman said.

Cencom also found savings by lengthening the cascades of amplifiers it plans to feed from each AM receive node. The operator discovered that leaving nine-amplifier cascades instead of four-amp cascades cut by one-third the required number of AM receive sites, Lehman said. ■

**EXHIBIT C**

**CONTACT:**

Gary Quackenbush/Matt Kresch  
Neale-May & Partners  
(415) 328-5555

Lela Cocoros  
Tele-Communications, Inc. (TCI)  
(303) 267-5273

**FOR IMMEDIATE RELEASE:**

**TELE-COMMUNICATIONS, INC. (TCI) ACCELERATES ITS FOUR-YEAR,  
\$2 BILLION, NATIONWIDE FIBER OPTIC CONSTRUCTION PROJECT**

**Company Spending in 1993 Set at \$750 Million to Build  
"The Infostructure Network™" in More Than 100 Cities**

ENGLEWOOD, Colorado (April 12, 1993) -- Tele-Communications, Inc. (TCI), (NASDAQ:TCOMA/TCOMB), today announced plans to accelerate the upgrade or replacement of its backbone coaxial cable facilities using fiber optic cable over the next four years at an estimated cost of more than \$1.9 billion.

The new fiber systems will pave the way for an entirely new era of high-capacity lightwave communications and innovative customer options -- many of them interactive -- while improving TV picture quality and service reliability.

Work in 1993 alone will impact some 28,000 miles of TCI's plant, creating employment opportunities for a variety of local vendors and contractors coast to coast. Of this total, some 7,000 miles of fiber cable will be installed. Each cable contains an average of 24 fiber strands, resulting in a total of 168,000 fiber miles to be constructed this year.

**MORE**

Construction of TCI's 21st century communications infrastructure, which the company has named "The Infostructure Network™", will involve expenditures of \$750 million in over 100 U.S. cities during 1993 alone. This project will be extended to include more than 250 cities, towns and counties by the end of 1996.

"The Clinton Administration has proposed a \$17 billion, government-coordinated, communications infrastructure development plan that would build a two-way information superhighway of fiber optic cable across America," said John Malone, President and Chief Executive Officer of TCI.

"All agree that private enterprise must pull the strongest oar in meeting this need. 'The Infostructure Network™' program announced today is a major step toward realizing this goal. TCI is proud to be a key player contributing to this national priority," Malone said.

This project has already begun in four company-designated regional "super hubs" including: Pittsburgh, PA; South Florida/Miami, FL, Denver, CO, and the San Francisco Bay Area, CA.

Four additional hub conversions are scheduled to begin this year in Chicago, IL; Hartford, CT; Salt Lake City, UT and St. Louis, MO. This effort is also underway in many other communities across the nation. This technical upgrade process will quickly expand across the country. TCI estimates that 90 percent of its 10 million customers will be served by the new networks by 1996.

"We believe this project is the largest private sector telecommunications undertaking in our nation's history, considering the number of customers involved and the relatively short time frame," said Brendan Clouston, Chief Operating Officer of TCI.

**MORE**

"Fiber will greatly increase the number of viewing choices available to our customers and is critical to the interactive future. It will give them more personalized control over their TV service. Fiber also increases the reliability of our systems, while reducing outages and improving picture quality in the home," Clouston said.

#### **More Customer Choice and Potential New Services**

This advanced network will be the delivery platform for a wide range of new, interactive services to come.

These new services will include interactive educational programming, multiplexed movie offerings, enhanced shop-at-home options, mass storage, data transfer and computer software delivery, cable commuting, a range of new "niche" programming services, many more sporting events and ultimately, an expanded array of on-demand television services.

#### **Digital Compression**

The company's decision to deploy digital compression (announced in December 1992) coupled with the system upgrades announced today -- which bring TCI's systems up to the 750 Megahertz (MHZ) throughput level. This will give TCI the capacity to handle virtually every advanced service customers may want well into the next century.

Today's average 450 megahertz cable system typically carries 54 channels of analog TV programming. With digital compression, this total could ultimately reach 500 channels or more -- depending upon customer demand for the new, optional services.

**MORE**

### **Advantages of Fiber Optics**

"Fiber gives us the added advantage of being able to transmit undistorted TV pictures over longer distances using less transmission equipment and fewer satellite earth stations and headends," said Richard Rexroat, Vice President — Engineering for TCI Cable Management Corporation, the company's domestic cable operations subsidiary. "We also gain the ability to reach the gigahertz level (one billion bits per second), essential for high-speed computer traffic and other large-scale data transfers."

A billion bits of data per second is equivalent to sending 60,000 pages of typewritten text over a network in just one second — 100 times the amount possible on non-fiber telephone communications systems today.

### **Fiber/Electronic Component Cost Reductions**

In planning this project TCI capitalized on the fact that the cost of fiber has declined 11 percent since 1990 while the cost of associated electronic components has also come down by 40 percent in the same period, making it more economical today to begin a systemwide reengineering project than at any other time since the dawn of the lightwave technology era.

Tele-Communications, Inc. is traded in the NASDAQ market with Class A Common Stock and Class B Common Stock trading separately under the symbols of TCOMA and TCOMB, respectively. In addition, the company's Liquid Yield Option Notes due 2008 are also traded in the NASDAQ market under the symbol of TCOMG.

XXX



**EXHIBIT D**

... WEDNESDAY, JANUARY 27, 1993 81

# Time Warner Plans Electronic 'Superhighway'

By JOHNNIE L. ROBERTS  
And MARY LU CARNEVALE

Staff Reporters of THE WALL STREET JOURNAL

Time Warner Inc. plans to build an "electronic superhighway," a high-capacity, computerized network to deliver movies on demand, interactive games, home shopping and telephone services.

Proclaiming the effort as the dawning of a "brave new world," Time Warner Chairman and Chief Executive Gerald R. Levin said the company is building the first two-way system this year in suburban Orlando, Fla., and will switch it on in early 1994. And he indicated that Time Warner is talking with potential partners in high-technology industries to help launch its systems in cities nationwide where it has local franchises as well as overseas.

Time Warner's move is the most ambitious yet in a spate of recently announced plans by companies aiming to link cable television, telecommunications, computers and consumer electronics. But such companies as American Telephone & Telegraph Co., International Business Machines Corp. and the regional phone companies are said to be close behind as the industry giants scramble to form alliances to service the entertainment and communications needs of the interactive home of the future.

Even so, Time Warner's announcement is ominous for local phone concerns, particularly the Baby Bells. Phone companies stand to lose a substantial chunk of revenues and profits if cable operators can link business and residential customers directly to their long-distance carriers, bypassing local phone networks.

News of the Orlando network sent Bell company shares south. In New York Stock Exchange composite trading, Ameritech Inc. fell \$1.125 to \$73; Bell Atlantic Corp., 37.5 cents to \$52.50; BellSouth Corp., 12.5 cents to \$53.75; Nynex Corp., \$1.125 to \$84; Pacific Telesis Group, 50 cents to \$46.25; Southwestern Bell, \$1 to \$71.875; and U S West, 50 cents to \$38.50.

GTE Corp. slipped 12.5 cents to \$35.50. Time Warner dropped 50 cents to \$31.875.

With its move, moreover, Time Warner also thrust the cable industry into a growing debate over whether private industry or government should build a national "electronic superhighway" for data, an infrastructure improvement strongly backed by the new administration.

President Clinton and Vice President Albert Gore believe that such a superhighway is critical to improving the nation's competitiveness, the economy, health care and education. But in particular, Mr. Gore contends that private industry — even if in the unlikely event that it would make the risky investment to build the superhighway — would restrict access to it. A government-controlled system would be open to all users.

But Time Warner is "committed to building a private network," Mr. Levin said. He added that other data suppliers could have access.

Mr. Levin also emphasized that Time Warner's system isn't some futuristic vision. "I don't want to wait for the 21st century; we're going ahead and building," Mr. Levin said. "We aren't waiting for some test results. . . . This is not some experiment with people running around simulating."

Several weeks ago, cable-TV giant Tele-Communications Inc. made headlines with its plans to introduce digital compression technology that would provide 500 or more channels in the future. Time Warner's planned system would go beyond compression, the company emphasized. The company said it would be the first cable operator to deploy computerized, or digital, switching technology and computerized storage to hold libraries of movies and other "information."

Those two technologies will enable Time Warner to store in "digitized" form its vast libraries of movies, books and magazines as well as other information and to direct them, like a traffic cop, to customers who order such data.

"This clearly puts them at the forefront of technology trends in home entertainment and information delivery," said Edward J. Atorino of Salomon Brothers.

Time Warner officials said the company is seeking proposals from equipment suppliers for the gear necessary to build the system, which initially will operate in an area with about 4,000 residential customers. They didn't elaborate on how much it expects to charge consumers for its various services. And while company officials insisted the revenue potential from the new services would be substantial, some in the industry questioned what the level of demand would be — and whether it will be enough to support the large investments required to provide the offerings.

Securities analysts and industry executives said Time Warner's plans have profound implications for entertainment consumers and purveyors, and for industries that include retailing, real estate, education and financial services.

Time Warner officials said they are certain to provide video-on-demand early on through the "full service network." The first offerings also will include home shopping and interactive "video education services," such as interactive video games that allow subscribers in different homes to play each other on the network.

Signaling its intentions to compete against phone companies, the company also said it applied to the Federal Communications Commission for an experimental license to test personal communications services and to provide connections to long-distance carriers and picture phone services. Business customers will be offered video-conferencing and high-speed data transport.

Company officials noted that the telecommunications market totals \$80 billion in revenues today and projected it to double by the year 2000. Leading its efforts in telecommunications is former FCC commissioner Dennis R. Patrick, now president and chief executive of Time Warner Telecommunications.

With the cable television company's entry into telecommunications, local phone companies' revenues from long-distance carriers for completing calls could be significantly eroded. "Long-distance access is unquestionably the single most lucrative part of a Bell company's business," said Jack Grubman, an analyst with Paine Webber Inc. "It accounts for about 25% of their revenues and close to two-thirds of their profits."

The phone companies, particularly the seven regional Bell companies, fear that regulatory and legal restrictions will exclude them from potentially lucrative markets for video-on-demand, interactive video and games and multimedia services that combine video, images, text, voice and music. "What's troubling to us is that Time Warner is able to do it, and we are not," said Tom Talke, head of Nynex's Washington office and a former congressman from Iowa.

Local phone companies are barred under the 1984 Cable Act from providing cable services within their territories. Moreover, the consent decree that broke up the Bell System prohibits the seven regional Bell companies from offering long-distance services and from manufacturing telecommunications equipment.

Even if restrictions were lifted, local phone companies would have to invest an estimated \$200 billion or more to install fiber-optic lines and high-capacity switching equipment.

# DISCOVERY DEBUTS REMOTE FOR 500-CHANNEL UNIVERSE

By KIM MITCHELL & GARY KIM

**D**ENVER — Discovery Communications Inc. moved into the technological fast lane last week with the announcement that it had developed a remote control ordering system that would simplify consumers' efforts to choose programming when the 500-channel world of digital compression comes into play.

The system, shown last week to the Cable Television Laboratories Inc. board of directors for the first time, is called "Your Choice TV." It combines a universal remote control, on-screen navigation and an electronic ordering system that allows consumers to search for, buy, view and tape broadcast and cable TV fare. The system also provides a convenient way to buy movies and other programs on an a la

carte, on-demand basis.

Intended to be used in conjunction with digital compression terminals in subscribers' homes and built right into the boxes themselves, the system also will support interactive

programming, including existing services such as Prodigy.

It could bring as much as \$15 billion to \$25 billion in incremental income to the broadcast and cable TV industries, said Discovery president and CEO John Hendricks.

The system's success hinges on its ability to simplify programming choices for a compression-era consumer faced with choosing from 50 broadcast and cable networks, 25 special-interest

*SEE DISCOVERY, PAGE 54*

*"As a programmer, I like knowing there's another revenue stream out there."*

*John Hendricks,  
president and CEO,  
Discovery Comm.*



# Discovery Debuts Remote for 500-Channel Universe

**CONTINUED FROM PAGE 1**  
pay-on-demand networks and 125 PPV movie channels. Discovery designed its on-screen system, remote control, preview and ordering systems after heavy focus group research.

"People's biggest complaint is that there isn't anything good on TV," Hendricks said. "This will offer viewers more than just what's on TV channels when they flip on the set."

Hendricks said the venture ties into Tele-Communications Inc.'s recently announced plans to work with AT&T and General Instrument Corp. to develop compressed digital format technology.

Discovery's cable operator partners — TCI, Newhouse Broadcasting Co. and Cox Cable Communications — are all supporting the project. But to make it a reality, the venture needs industrywide support, Hendricks said. Therefore, he will be stumping across the country in upcoming weeks in an effort to form a partnership of operators, programmers and technology vendors that would operate the project under the name of Cable Convergence Partnership.

Because the system focuses significantly on a la carte programming purchases, a more daunting task for Hendricks will be garnering support from broadcast and cable networks. Hendricks said he hopes to convince programmers of the incremental revenue advantages provided by the system.

A key hurdle will also be Madison Avenue. It has not been determined whether the a la carte aspects of the system would be sold with advertising, Hendricks said. Demonstrations to ad agencies will begin in the next two weeks.

By February, Hendricks said, he should have a sense of industry support and if things fall into place, the device could be available in mid-1994.

Hendricks said his evolution from software to hardware designer came about a year and a half ago, when he began contemplating how compression would affect his business. "For six months, I was just in a dilemma of how we were

going to play into this," he said. "What would we do?"

In an effort to solve his problem, Hendricks employed focus groups. Here's what he learned: Viewers don't want more channels, but they do want time-shifting and want an easy way to access programming.

Hendricks brought the idea of a new way of accessing programming to TCI last December and was given the green light to continue his research. "As a programmer, I like knowing there's another revenue stream out there," he said.

The current standard of programming interface — the remote based on a numeric keypad — will be "hopelessly antiquated" in the compression era, Hendricks said. Instead, a remote that uses both numbers and icons (for example: a button with a baseball for sports listings, plus a four-way cursor and "go" button) will provide a consumer friendly interface for consumers.

"This is personal television," said TCI research and development vice president Tom Elliot, a "huge change in viewing experience" that will allow customers to watch programs, not channels.

More important than that, however, is the change in the viewer-broadcaster relationship. Before, the programmer decided what viewers would see and when they'd see it. With hundreds of available channels, viewers will determine what they'll see, and when.

In a real sense, the 500-channel delivery system and new navigational tools represent the culmination of a process cable TV began in 1975, said Elliot. Cable took a half-step towards personal TV when retransmission of program-



ming took a back seat to the creation of new programming formats that gave customers more choice, he said.

The advent of the videocassette recorder also had the effect of further relaxing the historic connection between the transmission and consumption of video, said Elliot. When a consumer can pop in a tape and watch it at any time, that's a half-step towards personalized, custom TV.

Digital compression takes the final step towards a television experience that represents a "fundamentally changed medium," said Elliot. The new TV will be "distance independent, delivered with uniform quality to every customer and be a sort of 'metered' service instead of a bulk service," he said.

For the first time, "bandwidth" also assumes a more statistical, instead of physical, nature. Up to this

point, each channel delivered to the home has been a discrete and physical entity, marked by clear channel boundaries identifiable by frequency.

With compression and switching, a "channel" becomes a "virtual" concept, since programs are called up on demand and may share a physical channel.

If operators embrace the concept Hendricks has outlined, the industry's conversion to all-digital transmission from programmer studios and uplink sites into customer homes will be hastened.

Adopting the concept would also spur bandwidth upgrades, since maximum customer choice and control is obtained on systems offering 750 MHz or even higher bandwidth.

Hendricks suggested that a traditional 330-MHz system could, for example, set aside 48 MHz, or

eight 6-MHz channels, to deliver a menu featuring six hit movies starting every 30 minutes, two selections each in the sports, children's and documentary/news areas, four entertainment choices, four special-interest options, a promotional service and digital audio selections.

A 450-MHz system could clear 76 MHz (13 6-MHz channels) to offer six hit movies with 15-minute start windows, four selections each in the sports, children's, documentary/news areas, six entertainment channels, eight special-interest offerings, promotional and music channels.

A 750-MHz network could clear 108 MHz (18 conventional channels) to provide eight hit movies with 15-minute start windows, eight selections each in the sports, children's and documentary/news areas, 16 magazine-format offerings, promotional and digital audio channels as well.

In all, the nationally available menu would require about 18 transponders, most using an 8:1 or 10:1 compression ratio, while sports fare used a 4:1 ratio.

The offered programming could be varied dynamically over the week, offering more sports on Saturday afternoons in the fall, for example.

Though there's no reason all the digital services would have to be delivered on one satellite, that clearly makes the most logistical sense, said Hendricks. The service would be a straight digital-pass-through system, with no requirement for local digitization of analog material or local compression, Hendricks said.

The system would use eight transponders for hit movies and two for sports. Children's, documentary/news, entertainment and special interest selections would require a transponder each. Special-interest programming would be carried on two transponders.

The data stream required to keep the system running and provide interactive services would take one transponder, as would the promotional channel. Digital audio also would take one transponder. ■

**EXHIBIT E**

09/15/93 18:30 307-682 7942

CITY OF GILLETTE

002

'93-09-14 14:59 POWDER RIVER OFFICE SUPPLY

P.1

TCI CABLEVISION OF WYOMING, INC.  
 1800 WAGONHAMMER, GILLETTE, WY  
 82716-5358 8791 5900 462

GE 7 01

DATE SEPTEMBER 01, 1993

ACCT.#

USE ENCLOSED ENVELOPE  
 AND MAKE PAYMENT TO

\$31.26

ON RECEIPT

\$

PLEASE DETACH AND ENCLOSE TOP PORTION WITH PAYMENT

TCI OF WYOMING, INC.  
 1800 WAGONHAMMER  
 GILLETTE, WY 82716-5358

GILLETTE WY 82716-7529

DUE UPON RECEIPT. A \$2 ADMIN. CHG  
 WILL BE ASSESSED 25 DAYS FROM THE  
 BILL DATE IF PAYMENT IS NOT RECEIVED

8791 59 001 0100673		SEPTEMBER 07, 1993		OCTOBER 06, 1993		ON RECEIPT	
8/21	PREVIOUS BALANCE						29.85
	PAYMENT--THANK YOU						29.85 CR
	BASIC						16.25
	EXPANDED BASIC						3.25
	HOME BOX OFFICE						10.43
	FRANCHISE FEES						1.33
		***AMOUNT DUE**					\$31.26
PAYMENTS RECEIVED AFTER SEPTEMBER 01 ARE NOT INCLUDED IN THIS STATEMENT							
29.85	-	29.85	+	29.93	-	0.00	+
						0.00	+
						1.33	=
							\$31.26
AN AMOUNT FOLLOWED BY A (CR) IS A CREDIT OR A CREDIT BALANCE YOUR FRANCHISE AUTHORITY'S NAME AND ADDRESS IS: CITY OF GILLETTE CITY HALL, P.O. BOX 3003 GILLETTE, WY 82717 YOUR FCC COMMUNITY UNIT IS WY0027							

\*SSL

## SUBSCRIBER STATEMENT LEDGER

09/17/93

SUBSCRIBER #

30 DAYS

.00

STATUS

CUR BAL

31.26

60 DAYS

.00

DLQ DAYS

DLQ AMT

.00

90+DAYS

.00

GILLETTE WY 82716-7529

SEQ#	DATE FROM	TO	REFERENCE	DESCRIPTION	AMOUNT	BALANCE
	0901	0907	1006	----- BALANCE DUE -----		31.26
01	0901			FRANCHISE FEES	1.33	31.26
02	0901		HB	SRV HOME BOX OFFICE	10.43	29.93
03	0901		BD	SRV EXPANDED BASIC	3.25	19.50
04	0901		BA	SRV BASIC	16.25	16.25
05	0821		P00182110	PAYMENT--THANK YOU	29.85-	.00
	0801	0807	0906	----- BALANCE DUE -----		29.85
06	0801		HB	SRV HOME BOX OFFICE	10.95	29.85
07	0801		BD	SRV EXPANDED BASIC	1.00	18.90
08	0801		BA	SRV BASIC	17.90	17.90
09	0723		P00672303	PAYMENT--THANK YOU	29.85-	.00
	0701	0707	0806	----- BALANCE DUE -----		29.85
10	0701		HB	SRV HOME BOX OFFICE	10.95	29.85
11	0701		BD	SRV EXPANDED BASIC	1.00	18.90
12	0701		BA	SRV BASIC	17.90	17.90
13	0623		P00462306	PAYMENT--THANK YOU	29.85-	.00
	0601	0607	0706	----- BALANCE DUE -----		29.85

CIB241 \*\* PF7 = NEXT STATEMENT; PF8 = PREV STATEMENT \*\*

CITY OF GILLETTE

382 7842

08:16

09/21/93

**EXHIBIT F**



*We're taking television  
into tomorrow*



## TCL Cablevision of St. Louis

August 20, 1993

*TCL is making important new changes for the future of your cable.*

### DEAR CUSTOMER:

To comply with federal regulations under the 1992 Cable Act, we will be making some immediate changes to our channel line-up and charges for basic and expanded basic services. Some service and equipment rate levels may decrease in price while others may increase. Most changes are the result of rate formulas mandated by the federal government. Premium service customers will see a slight increase in rates. These rates have not increased in many years. These changes are effective on September 1, 1993. Rate adjustments and/or credits will be reflected on a subsequent bill.

**NOTE!**

### PRODUCTS AND SERVICES PRICE LIST

(all prices exclude applicable franchise fees and taxes)

The minimum level of cable service you may purchase is Basic Service. You may purchase Basic Service alone or with any other Optional Service(s) listed below.

### BASIC SERVICE—\$10.23 PER MONTH

KTVI, Bulletin Board, C-SPAN, HEC, The Family Channel, Prevue, WHSL, KDNL, KETC, KPLR, KNLC, KMOV, Local Origin, KSDK, Gov't Info, Leased Access, Local Origin, Public Access, BET, QVC, EWTN/VISN and Sneak Preview

### OPTIONAL CABLE SERVICES

### EXPANDED BASIC—\$11.16 PER MONTH

Courtroom Television, Headline News, Nickelodeon, The Nashville Network, VH-1/Comedy, USA, TBS, Univision, The Weather Channel, VJB, Lifetime, WGN, Arts & Entertainment, C-SPAN II, "E" Television, Music Television, CNBC, ESPN, TNT, ~~Gov't Access~~, American Movie Classics, The Discovery Channel, Prime Sports, Cable News Network

### PREMIUM SERVICES AND PAY-PER-VIEW SERVICES

Premium services may be purchased individually or, for greater savings, buy more than one and receive the Package Price.

### INDIVIDUAL PREMIUM SERVICE PRICES (per month)

HBO (Home Box Office).....	\$11.60
Showtime .....	10.60
The Disney Channel.....	8.60
Cinemax .....	10.60

4940 Delmar Boulevard  
St. Louis, MO 63108-1669  
(314) 381-7300

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